

### REMARKS

Applicants have amended their claims by adding new claims 14-16 to the application. Claims 14 and 15, each dependent on claim 1, respectively further defines amount of antimony compound contained in the polyester resin (B) and further defines concentration of phosphorus compound; and claim 16, also dependent on claim 1, recites amount of polyamide resin (A) and polyester resin (B) in the resin composition. In connection with new claims 14-16, note, for example, pages 8, 10 and 12, of Applicants' specification. Moreover, Applicants have amended claim 5 to correct a typographical error therein.

Applicants respectfully traverse the rejection of claim 6 under the first paragraph of 35 USC 112, as failing to comply with the enablement requirement. In connection with this rejection, the Examiner contends that a "compound having a pK<sub>b</sub> of 4.50-6.99 is acidic". Applicants respectfully traverse the contention by the Examiner that a compound having a pK<sub>b</sub> of 4.50-6.99 is acidic. That is, it is noted that the value is pK<sub>b</sub>, not pK<sub>a</sub>. As is known in the art, pK<sub>b</sub> is a logarithm of base disassociation constant, not of acidic disassociation constant. This can be seen in the enclosed pages 361-364 of the text book by Bassett, et al., Principles of Chemistry (1966), discussing pK<sub>a</sub> and pK<sub>b</sub>. It is respectfully submitted that a pK<sub>b</sub> of 4.50-6.99 is basic, not acidic, and that the recitation in Applicants' claim 6 of a basic compound having a pK<sub>b</sub> of 4.5 or more is accurate.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed August 26, 2005, that is, the teachings of Japanese Patent Document No. 2001-234064 (to Asahi Chemical Industry Co., Ltd.).

Initially, the contention by the Examiner in the last line of Item 4, on page 2 of the Office Action mailed August 26, 2005, is noted. In connection therewith, note that according to the records of the undersigned, upon originally filing the European Search Report with the Information Disclosure Statement submitted March 2, 2004, an English abstract of No. 2001-234064 as filed, as indicated on the Form PTO-1449 submitted with such Information Disclosure Statement. Note that the Examiner has initialed the Form PTO-1449 submitted with this Information Disclosure Statement filed March 2, 2004, which indicated submission of a translation/abstract with No. 2001-234064. Thus, the Examiner has initialed that he has considered the reference, set forth as including a translation/abstract.

In any event, enclosed herewith please find a copy of the Abstract as submitted with the European Search Report submitted with the Information Disclosure Statement filed March 2, 2004, as well as an Abstract of No. 2001-234064 from the Patent Abstracts of Japan and a computer translation of claims of No. 2001-234064. In view of the Abstract/translation submitted herewith, consideration of the substance of the Japanese patent document is respectfully requested.

The additional statement by the Examiner in Item 4 on page 2 of the Office Action mailed August 26, 2005, that the Examiner "accepts the conclusions of the European Search Report without any reservations", is noted. A conclusion of the European Search Report is that Japanese Patent Document No. 2001-234064 is a Category X document, that is, "particularly relevant if taken alone". It is respectfully submitted that this provides no basis for concluding that the Japanese patent document discloses, or would have suggested, the presently claimed subject matter within the meaning of 35 USC 102 and 35 USC 103.

In any event, and noting the enclosed Abstracts and computer translation of claims, as well as reference to No. 2001-234064 in the European Search Report submitted March 2, 2004, it is respectfully submitted that this reference as applied by the Examiner would have neither taught nor would have suggested such a polyester-based resin composition as in the present claims, having the recited lightness and wherein the polyamide resin (A) contains a phosphorus compound and the polyester resin (B) contains specific amounts of an antimony compound, and, moreover, wherein the composition further includes at least one compound (C) selected from the group consisting of inorganic acid salts and hydroxides of group-1 or -2 metals and transition metals and satisfying the expressions (1) and (2) in claim 1.

As will be discussed further infra, it is respectfully submitted that with polyester-based resin compositions including a polyester resin containing specific amounts of an antimony compound and a polyamide resin (A) containing a phosphorus compound, problems arise in connection with darkening of the resin composition because of depositing metallic antimony; and that the present invention avoids this problem through including the at least one compound (C) in the composition and where the at least one compound (C) satisfies the expressions (1) and (2) in claim 1.

Furthermore, it is respectfully submitted that the reference as applied by the Examiner would have neither taught nor would have suggested such a polyester-based resin composition as in the present claims, having features as discussed previously in connection with claim 1, and, moreover, wherein the polyamide resin (A) is prepared by polycondensation of specified components, in amounts, as in claim 2; and/or wherein the phosphorus compound contained in the polyamide resin (A) is at least one salt selected from the group set forth in claim 3; and/or wherein

the polyester resin (B) is prepared by polycondensation of components, in amounts, as set forth in claim 4, with the dicarboxylic acid component utilized in forming the polyester resin (B) comprising specified amounts of isophthalic acid as in claim 5; and/or wherein the compound (C) is a basic compound having a  $pK_b$  of 4.5 or more (see claim 6), in particular, wherein the compound (C) is at least one compound selected from the group set forth in claim 7; and/or further recitation of amounts of antimony compound and phosphorus compound included, respectively as in claims 14 and 15; and/or amount of polyamide resin (A) in the resin composition, as in claim 16.

Furthermore, it is respectfully submitted that the teachings of the applied reference would have neither taught nor would have suggested such a shaped article having at least one layer which is made of the polyester-based resin composition as defined in claim 1 (see claim 8), in particular, wherein the layer made of the polyester-based resin composition has a thickness as set forth in claim 9, or wherein the shaped article is made into a form of film or sheet (see claim 10); and would have neither taught nor would have suggested such packaging container molded from the polyester-based resin composition of claim 1 (see claim 11), in particular, which is a hollow shaped article having a mouthpiece portion of 2 mm thick or more (see claim 12), or which is produced by injection-molding and then blow-molding (see claim 13).

The present invention is directed to a resin composition including a polyamide resin and a polyester resin, and articles made therefrom.

Production of polyester resin is generally carried out in the presence of a metal catalyst containing, e.g., antimony atom, to increase the polymerization rate of monomers. It has been known in the art that a shaped article made of a polyester

resin that is produced using an antimony-bearing catalyst is slightly darkened because of the deposition of metallic antimony by the reduction of an antimony compound. To avoid decrease of commercial value of the shaped article, due to the darkening, the darkening is prevented by limiting amount of antimony compound used.

However, even when using a limited amount of antimony compound, if a shaped article is produced by melt-kneading and molding a polyester resin that is blended with poly(m-xylylene diadipamide) to improve gas barrier properties, darkening of an article formed from the blend is disadvantageously increased, because deposition of metallic antimony is promoted by phosphorus compound in the polyamide. Phosphorus is included in the polyamide to prevent coloring of the resin during melt processing. Thus, while it has been proposed to provide an article excellent in gas barrier properties made of a resin composition containing a thermoplastic polyester resin mainly constituted by ethylene terephthalate repeating units and a polyamide resin, this proposed structure is silent as to a problem of darkening of shaped articles by the action of phosphorus atom in the polyamide resin.

While it has also been proposed to produce a heat-resistant synthetic resin bottle from a poly(ethylene terephthalate) resin blended with a nylon mainly constituted by m-xylylene diamine and adipic acid, this proposed method provides no description in connection with disadvantageous darkening of the shaped article by the action of phosphorus atom in a polyamide resin.

In connection with the foregoing, note, especially, the paragraph bridging pages 3 and 4, and the first full paragraph on page 4, of Applicants' specification.

Against this background, Applicants provide a resin composition, and articles formed therefrom, which avoid the problem of disadvantageous darkening of the composition and articles formed therefrom, while providing a material having excellent gas barrier properties. Applicants have found that by including an inorganic acid salt or a hydroxide of a group-1 or -2 metal of the Periodic Table or transition metal in a specific proportion to the phosphorus compound in the polyamide resin, this deactivates the phosphorus atom to reduce darkening of the polyester resin. Note, especially, the paragraph bridging pages 4 and 5 of Applicants' specification.

As for advantages achieved according to the present invention, attention is respectfully directed to the Examples and Comparative Examples described on pages 18-20 of Applicants' specification, and set forth in Tables 1 and 2 on pages 20 and 21 of Applicants' specification. As can be seen particularly in the Tables, according to the present invention, darkening due to deposition of antimony atom in the polyester resin is effectively prevented, while the composition according to the present invention is excellent in gas barrier properties and also excellent in external appearance because of the prevention of the darkening. See the paragraph bridging pages 21 and 22, as well as the two full paragraphs on page 22, of Applicants' specification.

As seen in, e.g., the enclosed Abstracts of No. 2001-234064, this patent document discloses a resin composition suitable for an industrial material such as an automobile part, an electronic and electric part, an industrial mechanical part, etc., obtained by compounding (A) a polyamide with (B) a polyamide complex which includes an apatite type compound containing an organic substance insoluble in a phenyl compound, in specified amounts, and (C) a polyester-based resin.

It is respectfully submitted that No. 2001-234064 does not disclose, nor would have suggested, such a polyester-based resin composition as in the present claims, having, inter alia, the phosphorus compound contained in the polyamide resin (A) and the specified amount of antimony compound contained in the polyester resin (B), and problems arising in connection therewith with respect to disadvantageous darkening; and avoidance of such problems through incorporating the at least one compound (C) in the resin composition, where such at least one compound(C) and the other components satisfy the expressions (1) and (2) as in claim 1; and/or the other features of the present invention as in the other claims, and advantages thereof.

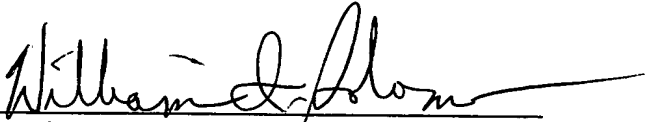
It is emphasized that the applied Japanese patent document does not disclose an included phosphorus compound, which promotes deposition of metallic antimony causing the darkening problem addressed by the present invention, contained in the polyamide; and, accordingly, it is respectfully submitted that the applied Japanese patent document would not have the problem addressed by the present invention, and clearly does not disclose such problem. Moreover, the applied Japanese patent document does not disclose avoiding the darkening problem by including the compound (C) as in the present claims, and clearly would have neither taught nor would have suggested providing such compound (C) so as to satisfy the specific expressions (1) and (2) as in the present claims, it being submitted that the applied Japanese patent document does not disclose, nor would have suggested, the specific expressions (1) and (2) as set forth in claim 1.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently pending in the application are respectfully requested.

Applicants request any shortage of fees due in connection with the filing of this paper be charged to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (case 396.43102X00), and credit any excess payment of fees to such Deposit Account.

Respectfully submitted,

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Attachment: Bassett, et al., Principles in Chemistry (1966) (6 pp.)

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**Principles of Chemistry by Lewis G. Bassett, Stanley C. Bunce,  
Alison E. Carter, Herbert M. Clark, and Henry B. Hollinger**

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The "ionization constant,"  $K_b$ , is given by

$$K_b = \frac{C_{BH^+} \times C_{OH^-}}{C_B} \quad (6-39)$$

**Example 6-2:** If a 0.8 M  $NH_3$  solution is found to be 1.5 per cent ionized, calculate the  $K_b$  and  $pK_b$  of the base.

It is evident from Eqs. (6-38) and (6-39) that, if the  $K_a$  value of an acid is known and also the total concentrations of the acid, then the concentration of the species in the solution of the acid can be determined (similarly for bases).

**Example 6-3:** Calculate the pH of a 0.30 M solution of acetic acid.  $K_a$  is  $1.85 \times 10^{-5}$ .

**Solution:** We have

$$K_a = 1.85 \times 10^{-5} = \frac{C_{H_3O^+} \times C_{CH_3COO^-}}{C_{CH_3COOH}} \quad (1)$$

We note that

$$C_{H_3O^+} = C_{CH_3COO^-}$$

and that

$$C_{CH_3COOH} = 0.30 - C_{H_3O^+}$$

Substituting in (1) above, we have

$$1.85 \times 10^{-5} = \frac{(C_{H_3O^+})^2}{0.30 - C_{H_3O^+}} \quad (2)$$

This is a quadratic equation which can be solved for  $C_{H_3O^+}$  by putting the equation in the form  $ax^2 + bx + c = 0$  and finding the roots,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Before undertaking this arduous task, let us consider the situation.  $K_a$  is small,  $C_{H_3O^+}$  must be small, particularly in comparison with the total concentration of the acid (0.30 M). As an approximation, let us neglect the  $C_{H_3O^+}$  in the denominator of (2) above. Our equation then becomes

$$1.85 \times 10^{-5} = \frac{(C_{H_3O^+})^2}{0.30}$$

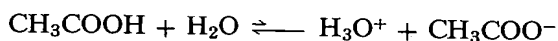
$C_{H_3O^+}$  comes out  $2.35 \times 10^{-3}$  m/l; and pH is 2.63 (check).

The student should verify the approximation in this case by solving the quadratic and comparing the result with the result above.

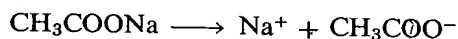
Let us alter Exercise 6-3 a bit so that it is required to calculate the pH of a 0.30 M solution of acetic which is also 0.30 M in sodium acetate, i.e., the solution contains 0.30 m/liter of the acid and 0.30 m/liter of the salt of the acid.

Common-ion  
effect—buffers

The chemical equilibria involved are:



and



Note that the salt is assumed to be completely ionized, and that there are two sources of the  $\text{CH}_3\text{COO}^-$  in solution, the major one being the salt. The  $\text{Na}^+$  plays no part in the equilibrium relations in the solution, and the relationship between the concentrations of the  $\text{CH}_3\text{COOH}$  (un-ionized), the  $\text{H}_3\text{O}^+$  and the  $\text{CH}_3\text{COO}^-$  is given by the mathematical expression for the  $K_a$  of the acid:

$$K_a = \frac{C_{\text{H}_3\text{O}^+} \times C_{\text{CH}_3\text{COO}^-}}{C_{\text{CH}_3\text{COOH}}} = 1.85 \times 10^{-5} \quad (1)$$

Now

$C_{\text{CH}_3\text{COO}^-} = 0.30$  m/liter from the salt plus that from the dissociation of the acid, which is small and equal to the  $C_{\text{H}_3\text{O}^+}$  whose sole source is the dissociation of the acid  $= 0.30 + C_{\text{H}_3\text{O}^+} \approx 0.30$  m/liter;

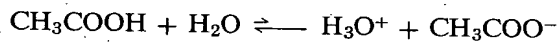
$C_{\text{CH}_3\text{COOH}} = 0.30$  m/liter minus that which dissociates, which is small and equal to the  $C_{\text{H}_3\text{O}^+}$  resulting from the dissociation  $= 0.30 - C_{\text{H}_3\text{O}^+} \approx 0.30$  m/liter.

Making these approximations and substituting in (1) above, we have

$$\frac{C_{\text{H}_3\text{O}^+} \times 0.3}{0.3} = 1.85 \times 10^{-5}$$

Then  $C_{\text{H}_3\text{O}^+}$  is  $1.85 \times 10^{-5}$  m/liter and the  $p\text{H}$  comes out 4.73. Comparing this result with that of Exercise 6-3, we see that the  $p\text{H}$  is increased and the acidity is decreased in a solution of the weak acid (acetic) by the addition of an ion ( $\text{CH}_3\text{COO}^-$ ) which is common to the acid and to a completely ionized salt of the acid. This phenomenon is known as the *common-ion effect*. It plays a large part in the applications of solution chemistry, especially in analytical chemistry.

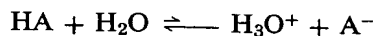
Looking at the common-ion effect qualitatively, we see that it is an example of the Le Chatelier principle. An increase in acetate-ion concentration represses the ionization, and therefore the acidity of an acetic acid solution.



Furthermore, from the Bronsted viewpoint, acetate ion is the conjugate base of acetic acid, and the addition of a base to a solution should decrease its acidity.

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Weak acids and bases exist largely in the un-ionized form in solution. We will investigate the complex equilibria which result. Let us denote a univalent weak acid as HA. The ionization equation is



The ionization constant is

$$K_i = \frac{C_{\text{H}_3\text{O}^+} \times C_{\text{A}^-}}{C_{\text{HA}} \times C_{\text{H}_2\text{O}}}$$

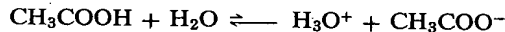
Since  $C_{\text{H}_2\text{O}}$  is constant, we have

$$K_i \times C_{\text{H}_2\text{O}} = \frac{C_{\text{H}_3\text{O}^+} \times C_{\text{A}^-}}{C_{\text{HA}}} = K_a \quad (6-38)$$

The quantity  $K_a$  [unfortunately this is also usually called the ionization constant, although it is not strictly true as we see from Eq. (6-38)] is a characteristic of each weak acid, depending as it does on its degree of ionization.  $K_a$  values are, of course, small numbers, and the  $p$ -notation is frequently used ( $pK_a = -\log K_a$ ).  $K_a$  and  $pK_a$  values are determined experimentally, and a tabulation of such values gives a quantitative measure of the relative strengths of weak acids. Such a table is given in Appendix 10.

**Example 6-1:** A 0.10 M solution of acetic acid,  $\text{CH}_3\text{COOH}$ , is found to be 1.36 per cent ionized. Compute the  $K_a$  and the  $pK_a$  of the acid.

**Solution:** The chemical equation for the process is



The mathematical expression for  $K_a$  is

$$K_a = \frac{C_{\text{H}_3\text{O}^+} \times C_{\text{CH}_3\text{COO}^-}}{C_{\text{CH}_3\text{COOH}} \text{ (un-ionized)}}$$

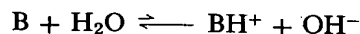
Now  $C_{\text{H}_3\text{O}^+} = C_{\text{CH}_3\text{COO}^-} = 0.10 \times 0.0136 = 0.00136$  m/liter

and  $C_{\text{CH}_3\text{COOH}} \text{ (un-ionized)} = 0.10 - 0.00136 = 0.09864$

Then  $K_a = \frac{(0.00136)^2}{0.09864}$  or  $\frac{(1.36 \times 10^{-3})^2}{9.86 \times 10^{-2}} = 1.85 \times 10^{-5}$  m/liter,

and  $pK_a = -\log (1.85 \times 10^{-5}) = -0.27 + 5 = 4.73$

Weak bases are treated similarly. Let us denote a univalent weak base as B. The ionization equation is



The common-ion effect serves as an introduction to another interesting application of acid-base equilibria. In the numerical example immediately preceding, it may be noted that the  $pH$  of the solution (with equal concentrations of acid and salt) is the same as the  $pK_a$  of the acid. Let us investigate this further by deriving the log form for the equation for the  $K_a$  of a weak acid, HA.

$$K_a = \frac{C_{H_3O^+} \times C_{A^-}}{C_{HA}}$$

$$\log K_a = \log C_{H_3O^+} + \log \frac{C_{A^-}}{C_{HA}}$$

$$pK_a = pH - \log \frac{C_{A^-}}{C_{HA}}$$

$$pH = pK_a + \log \frac{C_{A^-}}{C_{HA}} \quad (6-40)$$

We note that we may establish the  $pH$  of a solution by varying the ratio of concentration of salt to acid. A solution whose  $pH$  has so been established is said to be *buffered*, and the particular combination of weak acid and its salt chosen for the purpose is called a *buffer mixture*.

A buffered solution has another important characteristic. Not only is the  $pH$  established, but it is also considerably stabilized. In effect a considerable reservoir of  $A^-$  is available to react with any  $H_3O^+$  added to the solution, and thus the solution resists an increase in acidity. Similarly a considerable reservoir of HA is available to react with any  $OH^-$  added, and thus the solution resists a decrease in acidity. The student is advised to work Problems 6.19–6.21 at the end of the chapter to clarify his own understanding of this phenomenon.

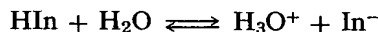
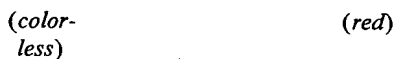
It was stated earlier in this section that  $pH$  may be measured by means of indicators. We now have a sufficient background in acid-base equilibria to discuss indicator action. In general, an indicator is some sort of signal system which indicates the progress or extent of a reaction. Acid-base indicators are weak organic acids or bases of complex composition which exist in dilute solution in two different highly colored forms. For example, the undissociated acid or base is one color (or colorless) while the conjugate form produced by dissociation is another color. The indicator itself does not appreciably affect the  $C_{H_3O^+}$  of the solution, since it is added in extremely small quantities.

Indicators

We will illustrate indicator action with two indicators in common use: one an indicator acid, phenolphthalein, which we will denote by the

formula  $\text{HIn}$ ; and the other an indicator base, methyl orange, which we will denote by the formula  $\text{In}$ .

For phenolphthalein, we have



$$K_a = \frac{C_{\text{H}_3\text{O}^+} \times C_{\text{In}^-}}{C_{\text{HIn}}}$$

or

$$\text{pH} = \text{p}K_a + \log \frac{C_{\text{In}^-}}{C_{\text{HIn}}}$$

It may be seen above that phenolphthalein is a one-color indicator. If we assume that, in the extremely dilute solution, the red color of  $\text{In}^-$  is visible to the eye when  $C_{\text{In}^-}$  equals  $C_{\text{HIn}}$ , then  $\text{pH} = \text{p}K_a$  and, since  $\text{p}K_a$  indicates the  $\text{pH}$ , it is denoted by  $\text{p}K_{\text{Ind}}$  and called the indicator constant. The  $\text{p}K_{\text{Ind}}$  for phenolphthalein is about 9.3, so that this indicator indicates a basic solution.

For methyl orange, we have



or

$$\text{pOH} = \text{p}K_b + \log \frac{C_{\text{InH}^+}}{C_{\text{In}}}$$

Methyl orange is a two-color indicator. If we assume that the transition color (orange) is visible to the eye when  $C_{\text{InH}^+}$  equals  $C_{\text{In}}$ , then

$$\text{pOH} = \text{p}K_b$$

and since we wish the  $\text{p}K_{\text{Ind}}$  to indicate the  $\text{pH}$ ,

$$\text{p}K_{\text{Ind}} = 14 - \text{p}K_b = \text{pH}$$

The  $\text{p}K_{\text{Ind}}$  for methyl orange is about 3.5, so that this indicator indicates an acid solution.

There are many weak acids and bases of this type with varying values of  $\text{p}K_{\text{Ind}}$ , so that indicators are available to indicate a wide range of  $\text{pH}$  values.

Polyvalent acids  
and bases

In our discussions so far, we have limited ourselves to substances which can donate or accept only one proton, i.e., monobasic acids or monoacidic bases, sometimes called monoprotic substances. When we consider *polyprotic* substances, the situation is more complicated, and it is necessary to